

CLAIMS:

1. A motor comprising:
  1. a stator, which has a plurality of magnetic poles arranged along the circumferential direction of the stator;
  2. an armature rotatable relative to the stator, the armature including:
    1. a core having a plurality of teeth, wherein a coil is wound about each tooth;
    2. a commutator, which has a plurality of segments arranged along the circumferential direction of the commutator; and
    3. a plurality of short-circuit members, wherein each short-circuit member short-circuits a predetermined number of segments with one another; and
    4. an anode supply brush and a cathode supply brush, wherein the supply brushes slide against the commutator, and wherein each short-circuit member has a base portion and an angular interval about the axis of the commutator, wherein each of the arms extending from the base portion corresponds to one of the predetermined number of segments to be short-circuited and has a segment connection portion to which the corresponding segment is connected, such that the short-circuit members form a laminated body, and wherein the base portions are laminated to have a multi-layer structure along the axial direction of the commutator, wherein the arms are formed such that the segment connection portions are located in the same position with respect to the axial direction of the laminated body.
2. The motor according to claim 1, wherein the base portion of each short-circuit member is annular or arcuate.

3. The motor according to claim 2, wherein an insulating member is located between the base portions of each adjacent pair of the layers in the laminated body, and wherein the insulating members have a diameter greater than the diameter 5 of the base portions and are formed not to interfere with the arms.

4. The motor according to claim 1, wherein the arms include bent arms, and wherein the bent arms are bent such 10 that the corresponding segment connection portions are each located in a different position from the position of the corresponding base portion with respect to the axial direction of the laminated body.

15 5. The motor according to claim 4, wherein each bent arm has a first portion radially extending from the corresponding base portion, a second portion extending in the axial direction of the laminated body from the distal end of the first portion, and a third portion radially extending from the 20 distal end of the second portion, and wherein the segment connection portion is provided at the third portion.

6. The motor according to claim 4, wherein the short-circuit member that is located at an axial end of the 25 laminated body is a first short-circuit member, wherein the arms of the first short-circuit member are not bent, and wherein all the segment connection portions are located in a single plane that is perpendicular to the axis of the laminated body and contains the first short-circuit member.

30 7. The motor according to claim 6, wherein each bent arm has a first portion radially extending from the corresponding base portion, a second portion extending in the axial direction of the laminated body from the distal end of the 35 first portion, and a third portion radially extending from the

distal end of the second portion, wherein the segment connection portion is provided at the third portion, and wherein the greater the distance from the first short-circuit member in the axial direction of the laminated body is, the 5 greater the length of the second portions of the short-circuit member becomes.

8. The motor according to claim 1, wherein the number of the magnetic poles is represented by  $2N$  ( $N$  is an integer 10 number greater than or equal to three), wherein the number  $M$  of the coils is represented by  $2N\pm2$ , and wherein the number  $S$  of the segments is represented by  $N\times M$ .

9. The motor according to claim 8, wherein the number of 15 the magnetic poles is six, the number of the coils is eight, and the number of the segments is twenty-four, and wherein each short-circuit member short circuits three of the segments.

20 10. The motor according to claim 1, wherein the arms of each short-circuit member radially extend from the base portion, and are arranged at a predetermined angular interval about the base portion.

25 11. The motor according to claim 10, wherein the short-circuit members are laminated such that all the arms do not interfere with one another with respect to the circumferential direction of the laminated body.

30 12. The motor according to claim 10, wherein the arms include specific arms each of which is provided with a connector at the distal end, wherein each connector is connected to an end of one of the coils, and wherein the width of the connectors is greater than the width of the arms with 35 respect to the circumferential direction of the short-circuit

members.

13. The motor according to claim 12, wherein each connector includes a pair of holding portions for holding one 5 end of the corresponding coil.

14. The motor according to claim 1, wherein two of the arms of each short-circuit member are each provided with a connector, and wherein one of the two connectors is connected 10 to an end of one of the coils and the other connector is connected to an end of another coil.

15. The motor according to claim 1, wherein one of the arms of each short-circuit member is provided with a connector, 15 and wherein the connector is connected to an end of one of the coils and to an end of another coil.

16. The motor according to claim 1, wherein at least part of the laminated body is located in the axial range of 20 the core.

17. The motor according to claim 16, wherein the core has a center bore extending through the core, wherein the armature includes a rotary shaft about which the commutator 25 and the laminated body are fitted, and a coupling member for coupling the core with the rotary shaft, wherein the coupling member is fitted about the rotary shaft and fitted to the center bore, and wherein the coupling member has a hollow portion for accommodating at least part of the laminated body.

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18. The motor according to claim 17, wherein the coupling member has a cylindrical portion and a bottom portion, wherein the cylindrical portion is fitted to the center bore of the core, wherein the bottom portion is located in the 35 axial range of the cylindrical portion, and wherein the bottom

portion, together with the cylindrical portion, defines the hollow portion in the coupling member.

19. The motor according to claim 18, wherein the  
5 laminated body is located between the core and the commutator with respect to the axial direction of the rotary shaft, and wherein the bottom portion is located at an axial center of the cylindrical portion or at a section of the cylindrical portion that is farther from the commutator than the axial  
10 center.

20. The motor according to claim 18, wherein the coupling member has a fixing portion, wherein the fixing portion extends from the bottom portion in the axial direction of the coupling member and is fitted about the rotary shaft.  
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21. The motor according to claim 17, wherein the laminated body is located between the core and the commutator with respect to the axial direction of the rotary shaft, and wherein the segment connection portions are located at a  
20 position in the vicinity of an axial end of the laminated body, the axial end being closer to the commutator.

22. A motor comprising:  
25 a stator, which has a plurality of magnetic poles arranged along the circumferential direction of the stator;  
an armature rotatable relative to the stator, the armature including:  
a rotary shaft;  
30 a core, which is fitted to the rotary shaft and has a plurality of teeth, and wherein a coil is wound about each tooth;  
a commutator, which is fitted to the rotary shaft and has a plurality of segments arranged along the  
35 circumferential direction of the commutator; and

a plurality of short-circuit members, wherein each short-circuit member short-circuits a predetermined number of segments with one another; and

an anode supply brush and a cathode supply brush,

5 wherein the supply brushes slide against the commutator, and wherein the supply brushes are arranged at a predetermined angular interval about the axis of the commutator,

wherein each short-circuit member has an annular or arcuate base portion and a plurality of arms radially

10 extending from the base portion, wherein each of the arms of each short-circuit member corresponds to one of the predetermined number of the segments to be short-circuited and has a segment connection portion at the distal end, and wherein the corresponding segment is connected to the segment

15 connection portion,

wherein the base portions are laminated to have a multi-layer structure along the axial direction of the commutator such that the short-circuit members form a laminated body, and wherein the laminated body is located between the core and the

20 commutator and fitted to part of the commutator, and

wherein the arms are formed such that all the segment connection portions are located in a single plane perpendicular to the axis of the laminated body.

25 23. The motor according to claim 22, wherein the short-circuit member that is closest to the commutator is a first short-circuit member, wherein the arms of the first short-circuit member are located in the single plane and are not bent, and wherein the arms of the other short-circuit members

30 are bent arms, and wherein the bent arms are bent such that the corresponding segment connection portions are each located in a different position from the position of the corresponding base portion with respect to the axial direction of the laminated body.

24. The motor according to claim 22, wherein the core  
has a center bore extending through the core, wherein the  
armature includes a coupling member for coupling the core with  
the rotary shaft, wherein the coupling member is fitted about  
5 the rotary shaft and fitted to the center bore, and wherein  
the coupling member has a hollow portion for accommodating at  
least part of the laminated body.

25. The motor according to claim 24, wherein the  
10 coupling member has a cylindrical portion and a bottom portion,  
wherein the cylindrical portion is fitted to the center bore  
of the core, wherein the bottom portion is located in the  
axial range of the cylindrical portion, and wherein the bottom  
portion, together with the cylindrical portion, defines the  
15 hollow portion in the coupling member.